

# Droplet Pinning in Microgravity

## Problem Statement

- The Ring Sheared Drop (RSD) is a module for the LMM aboard the ISS that will probe the biophysics of protein amyloids via fluid dynamics.
- Amyloid fibrils are implicated in Alzheimer's and other neuro-degenerative diseases.
- Droplet formation and pinning onto two knife edge rings must be tested for RSD development.
- Aside from protein amyloid formation and fibrillization, the RSD is useful for other studies of the air/water interface, e.g. 2D protein crystallization and evolution of microbial colonies, where microgravity allows *containerless bioprocessing*.

## Technology Development Team

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## Proposed Flight Experiment

### Experiment Readiness:

- Experiment will be ready within three months of grant initiation.

### Test Vehicles:

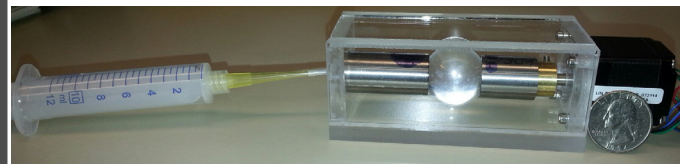
- Parabolic flight aircraft (contracted through "Zero Gravity Corporation")

### Test Environment:

- Microgravity environment permits fluid to be surface tension constrained

### Test Apparatus Description:

- Apparatus will be an enclosed, acrylic box with two stationary rings, and a port on one side for filling using a syringe.
- Syringe will inject water between the two rings, growing a drop until it reaches the rings.
- After each parabolic microgravity period, a new enclosure will be tested with the same type of rings or different - depending on the success of the previous run - where filling technique, including fill rate and syringe position relative to rings can be varied.



Mock-up of RSD; note, device for proposed FO will not require a motor.

## Technology Maturation

- Current TRL 4 will be advanced to TRL 5 through on-going project (NNX13AQ22G) which does not require microgravity.
- Advancement to TRL 6 requires testing of droplet pinning at microgravity.
- With a proposed start date of the grant ca. April 2015, we expect to have the first prototypes ready for testing in Sept. 2015. Flight reservations are for Nov. 2015 at Cape Canaveral, FL, providing enough time for redesigns.

## Objective of Proposed Experiment

- Test the ability of simple mechanisms to create and pin a 1" diam. droplet in microgravity.
- Test stability of pinned drops to vibration for different knife edge shapes and coatings.
- Test effect of syringe detachment and withdrawal.
- Data will be taken using a high speed camera.